XXIV.—*Facts concerning the importation or non-importation of* Diptera *into distant countries.* By C. R. Osten-Sacken.

[Read October 1st, 1884.]

The conditions attending the importation of Diptera across the ocean to distant parts of the world are not so simple and so uniform as one might suppose. Importation will not occur for centuries in cases where it might be expected from day to day; and again, it will sometimes take place under circumstances most improbable, and *à priori* impossible to foresee. My purpose, in publishing a few cases of importation and non-importation which I have been able to investigate, is to invite the attention to such occurrences, principally in the colonies of Great-Britain, where they must be continually going on, and, unless noted down by contemporaries, must be easily forgotten and lost to science. The close investigation of phenomena of that class may even have a bearing on some questions connected with the distribution of insects in geological time.

The substance of this paper has been published by me in German, in the 'Stettiner entomologische Zeitung' (No. 4 case in 1861; the other cases in 1880).

1.—Eristalis tenax.

"*Eristalis tenax* is in its way a remarkable phenomenon, for which there does not seem to exist any other boundaries in time or space (vertically or horizontally) than those which put an end to insect-life in general. It flies round the top of our Schneeberg, and it is equally common in the sewers of the city of Vienna. And when the frosty November fogs have swept out all insect-life, recently hatched, but torpid, specimens of *E. tenax* may still be frequently seen on walls and fences" (Frauenfeld, Beitr. z. Fauna v. Dalmatien, in the Verh. Zool.-Bot. Verein, 1856).

Eristalis tenax occurs throughout Europe; in Lapland, where it is common, as well as in Southern Italy,

Corsica, and Malta; in Algiers (Loew, Sudafr. Dipt., p. 318); in Gibraltar and Madeira (Schiner, Novara, 360); in Cairo and round Mount Sinai (Walker, Entom., v., 274); in the Canary Islands, Madagascar, and Bourbon (Macq., Dipt. Exot., ii., 2, p. 30); in China (Schiner, Dipt. Austriaca, Syrphidæ, p. 114); in Siberia and Japan (Loew., Wien. Ent. Monatschr., ii., p. 101); in Northern Persia (Rondani, Ann. Mus. Civ. Gen., iv., p. 295); it is also common in Syria (Schiner, *l. c.*). For the occurrence at the Cape I do not find any authority, except the passage in Schiner, *l. c.*, p. 10, where it seems to be a *lapsus calami*, as the statement is not repeated under the head of *E. tenax* on p. 114.

During my twenty years' collecting in North America I had never met with this species, until November 5th, 1875, when I found a specimen, to my great astonishment, on a window in Dr. Hagen's house in Cambridge, Mass. A year later, October and November, 1876, I observed several specimens on fences in Newport, Rhode Island. In June, 1877, I left America, but, as I ascertained afterwards, during that year the fly had become so common that, according to Dr. Hagen's statement, "hundreds were caught" (see his Lecture before the Soc. of Nat. History in Boston, Dec. 18, 1877). Between 1876 and 1878 many specimens were taken in the vicinity of Boston, in Galena, Illinois (compare Psyche, ii., p. 260), and even in Georgia (Psyche, ii., p. 188). Mr. Williston (Can. Ent., 1881, p. 176) says that it had become very common in New Haven, Conn.; he also had received specimens from beyond the Rocky Mountains (Washington Territory). Von Roeder's collection in Hoym (Anhalt) contains specimens taken about 1876—77, in Georgia and Missouri, by the well-known collector Mr. Morrison.

This sudden appearance of *E. tenax* in all parts of the United States, in localities thousands of miles apart, and within a short period of three or four years, is a very extraordinary phenomenon, and requires an explanation. Two hypotheses as to its mode of introduction are possible.

E. tenax may have been imported from Europe in ships to one of the harbours on the Atlantic. But if this importation happened long ago it would have been noticed earlier; if it has taken place recently it leaves unexplained the almost simultaneous appearance of the

fly in Georgia, Missouri, Illinois, and even on the Pacific coast.

The other possible hypothesis is that *Eristalis tenax*, like some other European species (for instance, *Syrphus pyrastri*), was indigenous on the western side of the American Continent only, and not on the eastern; and that it began to spread eastward since civilization in its westward progress came in contact with the area of its occurrence. The Colorado-beetle reached the Atlantic in that way, and *A. Fulleri* is another remarkable instance. Dr. Horn says (Bull. Brooklyn Ent. Soc., No. 6, 1884):—"In 1874, when working with Dr. Leconte on the Rhynchophora, among all his material only a single specimen of *Aramiges Fulleri* was contained, and that came from Montana. A year or two later it was received from all parts of the country, and was dreaded as one of the worst hot-house pests. How did this species spread so suddenly over so large a territory? Prof. Lintner had first found the insect in 1876. Mr. Dimmock finds it very troublesome in hot-houses, particularly on roses." *E. tenax* may have reached Missouri and Illinois years ago without being noticed; it attracted attention as soon as it appeared on the Atlantic coast, where dipterologists could recognise it. This supposition is supported by the fact that *E. tenax* exists in Siberia and Japan; but it is somewhat weakened by the circumstance that, as far as I know, it has never been found in California. I have been collecting seven months in California, in 1876, and have carefully examined the collection of Henry Edwards, Esq., in San Francisco, without seeing a single specimen of that species. However that may be, the suddenness of the appearance of *E. tenax* on the Atlantic coast of North America is a very extraordinary fact; and if imported from Europe, this fly is a noteworthy instance of an importation after nearly four centuries of intercourse.

2.—Sarcophaga carnaria.

Importation, after all, is not such a very easy matter as it would seem. It took four centuries to import *Eristalis tenax* into America (if it was imported at all), a very common species spread all over the Old World, and which owes its very name to the remarkable powers of endurance of its larvæ. I will give now an instance of an equally common and equally enduring European

species which has not yet made its appearance in America.

Sarcophaga carnaria, like its congeners, shows, in the larva stage, most remarkable powers of endurance and adaptation. Putrid vegetable matter and dung (Bouché, Naturg. d. Ins., p. 60); meat, fresh or rotten; ulcers on men and animals suit it well (Portchinski, 'Trudy' of the Russian Ent. Soc., ix., p. 106—109). It will undergo its transformation even when starving and not full-grown (Portchinski, *l. c.*). When Claude Bernard introduced the larva artificially into the stomach of a dog, it came out undigested and alive with the dejections. Portchinski tried the same experiment with a frog and a bird (*Sylvia hortensis*); with the former the larva remained alive; with the latter it came out dead, but undigested.

Under such circumstances it was natural to expect that, of all flies which swarm around human dwellings, *S. carnaria* would be among the first introduced into North America; and yet such is not the case. After the publication of Mr. R. H. Meade's Monograph of European *Sarcophagæ* (Ent. Mo. Mag., xii., p. 216 *sqq.*, 1876), I sent him for comparison a collection of North American *Sarcophagæ*, in the expectation that European species would be found among them. Mr. Meade found in that collection twenty-four true *Sarcophagæ* and four *Sarcophagidæ* belonging to other genera; but among those species there was not a single one that could be absolutely identified with any European species. A single species from the Far West (Colorado and Lake Superior) comes very near the European *S. similis*, Meade.

Now it is well known that *Musca domestica*, *Cyrtoneura stabulans*, *Calliphora vomitoria* and *C. erythrocephala*, *Anthomyia canicularis* and *Stomoxys calcitrans*, all of them common European house-flies, are equally common in the Atlantic States of North America; and also that they have been imported into the most distant colonies, like Chili, Australia, and New Zealand, where they were not indigenous. *Rhyphus fenestralis*, *Scenopinus fenestralis*, and the handsome green-eyed *Scyphella flava* occur on windows in North America, just as much as in Europe. *Sarcophaga carnaria*, as far as I know, has never been mentioned as occurring in any of those countries. (All the above-named flies are, for instance, mentioned by Dr. Schiner in the Novara work as brought home from

distant regions, except *S. carnaria*. The single instance in Macq., Dipt. Exot., ii., 3, p. 95, that this species had been received from Haïti requires further confirmation).

It would seem, therefore, that there are some obstacles to the introduction of this species by means of shipping into distant countries. It may be that the chances of transportation are diminished in this case owing to the circumstance that *S. carnaria*, although living *about* human dwellings, does not often appear *within* them; and for this reason, even if it made its appearance on board ship, would be less apt to remain within it than the other house-flies. But as this reasoning is not applicable to the larvæ, the case remains doubtful.

Similar remarkable cases of *non-importation* may be quoted in the vegetable kingdom. A great many of the common European weeds have been imported into the United States, and have to a considerable extent, especially in the environs of towns and villages, almost crowded out the native flora. One might naturally have expected that the poppy and the blue-bottle (*Centaurea cyanus*) would be, with the cereals, among the first arrivals. Nevertheless these two weeds have never spread in America.

3.—Psilopus pallens.

This is an instance of importation under the most improbable circumstances. The dolichopodid *Psilopus pallens*, Wied., although it occurs along the Atlantic coast of North America, has the general appearance (colouring, &c.) of a European *Psilopus*, quite different from the numerous American representatives of that genus, which have the more brilliant colouring of tropical species. Wiedemann received it from North America more than half a century ago. When I sent Dr. Loew the first specimens which I found, he wrote me that they were absolutely identical with a species which he had found on the island of Rhodes (*Psilopus albonotatus*, Loew). This was remarkable, but I have gathered some facts since which bridge over the distance between Rhodes and New York. In the collection of Mr. Bergenstamm, in Vienna, I have seen specimens of the same species from Barcelona; and Mr. Van der Wulp informed me that it has been found in Amsterdam and in Haarlem (*cf.* Tijdschr. voor Ent., xi., p. 20).

New York was originally a Dutch colony, and *Psilopus pallens* may have been imported from Holland to New York very early. The peculiar mode of life of this species, quite different from its congeners, helps to explain the otherwise improbable fact of the importation by ship of a *Psilopus*.

Ordinary *Psilopus* run on leaves of plants, usually far from human dwellings. On the contrary, *P. pallens* I have always found in and about houses; I even took specimens on the walls of a foreign Consulate in one of the busiest quarters of the city of New York (Bowling Green). Other specimens were found by me on the outside walls of houses in Newport, Rhode Island and Sag Harbour, Long Island—that is, always not far from the sea-shore. Thus we are justified in supposing that *P. pallens*, in frequenting ships'-cabins, has been able to withstand the long voyage across the Atlantic. Still the wanderings of this species and its partiality for sea-ports are very remarkable, and it would be worth while to investigate the perhaps peculiar conditions of its metamorphosis.

4.—The Importation of Gnats (*Culex*) into the Sandwich Islands.

The following case may be typical of the mode of importation of gnats across the ocean:—About 1828—30 an old ship from Mazaltan, Mexico, was abandoned on the coast of one of the Sandwich Islands. Larvæ of *Culex* were probably imported in the water-tanks upon it. The natives soon became aware of the appearance round that spot of a—to them unknown—blood-sucking insect; it so far excited their curiosity that they used to congregate in the evening in order to enjoy the novelty. Since then the species spread in different localities, and in some cases became a nuisance.

This was related to me by Mr. T. R. Peale, the well-known American entomologist and artist, who visited the Sandwich Islands a few years later with the United States Exploring Expedition, under command of Capt. C. Wilkes (1838—40). A distinguished American, who spent many years on the islands and whose acquaintance I made in Washington, confirmed the story to me, and told me that he remembered positively that there were no mosquitoes on the islands about 1823.

This version is at any rate more probable than another which I read in the German periodical, 'Die Natur' (1857, p. 232), that gnats were intentionally imported into those islands by a mischievous sea-captain, in vengeance against the inhabitants!

However, as the genus *Culex* seems to be cosmopolitan, it is very probable that native species existed on some of the islands of the Pacific Ocean. I read in F. D. Bennet's 'Narrative of a Whaling Voyage round the Globe from the Years 1833 to 1836' (London, 1840) that on Raiatea, one of the Society Islands, he met with a grey *Culex*, handsomely spotted with black, which was very common and annoying in the jungle, but seldom appeared in the villages. On Pitcairn Island the same traveller was told that the mosquito (*Culex*) had been but recently introduced.

5.—Syrphus pyrastri.

The geographical distribution of this common species offers some peculiarities which deserve to be noticed. It is common throughout Europe, but not as far north as Lapland; it occurs in Egypt, Algiers, on the Canary Islands, and Madeira (Schiner, *l. c.*, and Macquart); eastwards it has been found in Moscow (Fedtchenko), Kharkow (Jaroscheffski), and in the Volga-Ural region (Eversmann). Its occurrence farther east is very probable, but data are wanting. The *S. lunatus*, Wiedemann, from China, which this author calls "the representative of the European *S. pyrastri*, only a little smaller," may perhaps be the same species.

A species which I cannot distinguish from *S. pyrastri* is quite common in the region between the State of Colorado and the Pacific Ocean, including California. Say discovered it as early as 1820 on the Arkansas River, near the Rocky Mountains—at a time, therefore, when that region was as distant from the centres of civilisation as some places in the interior of Africa are at present. He was aware of its resemblance to the European species, and for this reason called it *S. affinis*; the difference which he notices, "a somewhat darker colour," is unimportant.

We thus have in the occurrence of *S. pyrastri* on the western side of the American Continent a clear case of a *disconnected area* of distribution. Remarkable as this is, it is still more remarkable that the occurrence of *S.*

pyrastri is confined to the western side of the American Continent. As far as I know, it has never been found in the Atlantic States. As Say discovered it east of the Rocky Mountains more than sixty years ago, it is difficult to understand what prevented it from spreading farther east and reaching the Atlantic Ocean. It remains to be seen whether the increase of the intercourse between east and west in North America, which has taken place lately, will not in the end bring about that result. But it is difficult to conceive why it has not happened earlier. A species which occurs in St. Petersburg, in Egypt, and on the Canary Islands must possess, as to climate, considerable powers of adaptation.

S. pyrastri also occurs in Chili (see Macq., D. E., ii., pp. 83 and 88); for I have myself seen specimens from there, and this is a new instance of the relationship of the Chilian with the Californian fauna; but this same fact renders very improbable the hypothesis of the *importation* of that species on ships. If it had been imported from Europe to California and Chili, it would in all probability have been introduced to New York, Charleston, and other Atlantic ports much earlier.

S. pyrastri is not a circumpolar insect. I mean to say that the other Syrphi common to Europe and North America (*ribesii*, *topiarius*, Zett., *abbreviatus*, *lapponicus*, *umbellatarum*, L. (?), *cinctellus*, Zett. (?)) all occur in Lapland, and therefore may have reached America by way of Greenland, in an earlier geological period. *S. pyrastri* does not occur in Lapland, and is not an insect of the extreme north; therefore its occurrence in Western America can be explained only (barring the hypothesis of importation) *by a migration across the more temperate regions of Asia*, and then over the islands, connecting both continents. Still its non-occurrence in the Atlantic States remains unexplained.